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Summary of the PhD thesis

**Coherence of the load-bearing structure and the spatial form
in European office and mixed-use tall buildings**

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The doctoral dissertation consists of two volumes. The first part comprises analysis and research, and the second contains a bibliography, a table of figures and tables, as well as the attachment. The dissertation is an interdisciplinary work and its subject is the analysis and research of mutual relations between the spatial form and the load-bearing structure. The work is particularly concerned with the search for spatial-structural coherence: the complementation between the building form and its load-bearing structure – to obtain synergistic solutions. Additionally, the quantitative, height and functional developments as well as the locations of European buildings exceeding 100 m in height in the period 1940-2020 have been analyzed. The building design concepts of tall buildings from the first half of the twentieth century and the constructed buildings from the second half of the twentieth century were characterized. The research undertaken in the thesis concerned the analysis of buildings measuring between 150-250 m and completed in the years 2000-2017, including office and mixed-use buildings (with several dominant functions, including offices). The leading trends in the design of skyscrapers in the XXI century have also been described. Selected aspects (architectural and aesthetical, functional and spatial as well as technical and utility) influencing the shaping of European tall rise buildings were also analyzed, primarily in the context of their load-bearing structures and spatial forms. The presented data were the basis for the study of the interdependence and coherence in the form finding of load-bearing structures and spatial forms, with particular emphasis on the role of the building core. Research and analysis of the aerodynamic properties concerning the wind loads on tall buildings with asymmetrical, irregular shapes and with the height of about 200 m were an important part of the work. The effect of changes in the geometry of the building on the amount of wind loads was analyzed. The results on wind load values (obtained by means of standard, experimental and numerical methods) were compared in order to spatial and structural optimization and search for more coherent solutions.

Key words: tall buildings, high-rise buildings, skyscrapers, Europe, office buildings, mixed-use buildings, form-finding, interdependence, coherence, spatial form, load-bearing structure, wind influence

